Claims

1. A microstructure for chemical processing and manufacturing comprising a plurality of microchannel walls defining at least one microchannel for accommodating chemicals to be processed, at least one coating layer adhered to the plurality of microchannel walls defining said at least one microchannel, the coating layer including a catalyst support and a catalyst, wherein the plurality of microchannel walls comprise a frit of a material selected from the group consisting of glass, ceramic, glass-ceramic, and combinations thereof.

2. The microstructure of claim 1 wherein the plurality of microchannel walls comprise a material selected only from the group consisting of glass.

3. The microstructure of claim 1 wherein the plurality of microchannel walls comprise a material selected only from the group consisting of ceramic.

4. The microstructure of claim 1 wherein the plurality of microchannel walls comprise a material selected only from the group consisting of glass-ceramic.

5. The microstructure of claim 1 wherein at least one of the plurality of microchannel walls further comprises a porous membrane.

6. The microstructure of claim 1 wherein the at least one coating layer is applied to the plurality of microchannel walls by filling the at least one microchannel with a slurry.

7. The microstructure of claim 1 wherein the at least one coating layer comprises a plurality of coating layers.

8. The microstructure of claim 1 wherein the catalyst support comprises a sol binder.

9. The microstructure of claim 8 wherein the sol binder comprises an alumina sol binder.

10. The microstructure of claim 1 wherein the catalyst support comprises a sinterable particulate solid.

11. The microstructure of claim 10 wherein the sinterable particulate solid comprises boehmite.

12. The microstructure of claim 1 wherein the catalyst support comprises a molecular sieve.

13. The microstructure of claim 12 wherein the molecular sieve comprises a zeolite.

14. The microstructure of claim 1 wherein the catalyst comprises a material selected from the group consisting of group IVA, VA, VIIA, and VIIIA of the periodic table of elements.

15. The microstructure of claim 14 wherein the catalyst comprises a material selected from the group consisting of platinum, nickel oxide, silicon carbide and silicon nitride.

16. The microstructure of claim 1 wherein the microstructure is capable of operating at internal pressures of between about 6 bars and about 300 bars.

17. The microstructure of claim 1 wherein the microstructure is capable of operating at internal pressures of between about 6 bars and about 150 bars.

18. The microstructure of claim 1 wherein the microstructure is capable of operating at internal pressures of between about 15 bars and about 40 bars.

19. A method of manufacturing a microstructure for chemical processing and manufacture, the method comprising the steps of:

filing a microchannel with a slurry, the microchannel defined by a plurality of microchannel walls comprising a frit of a material selected from the group consisting of glass, ceramic, glass-ceramic, and combinations thereof and configured to accommodate chemicals to be processed;

removing a portion of the slurry from the microchannel such that a slurry layer coats the plurality of microchannel walls; and

heating the slurry layer for a sufficient time and at a sufficient temperature to cure and bind the slurry layer to the plurality of microchannel walls.

20. The method of claim 19 wherein the slurry comprises a catalytic support and a catalyst, and wherein the filling step comprises the step of delivering the slurry under pressure.

21. The method of claim 19, wherein the slurry comprises a catalytic support material selected from the group consisting of a binder sol, a sinterable particulate solid, or a molecular sieve, and wherein after the heating step, the method further comprising the step of filling the microchannel with a solution comprising a catalyst to impregnate the cured slurry with the catalyst.

22. The method of claim 19 further comprising the steps of:

removing the solution from the coated microchannel; and

heating the catalyst impregnated slurry for a sufficient time and at a sufficient temperature to form a catalyst impregnated coating on the plurality of microchannel walls.

23. The method of claim 19 further comprising the steps of:

depositing a glass frit on a first substrate;

molding the glass frit to define a microchannel; and

covering the molded glass frit with a second substrate.

24. The method of claim 23 further comprising the step of performing the molding step under vacuum.

25. The method of claim 19 further comprising the step of forming the microstructure walls utilizing a wet etching process.